

ENVIRONMENTAL ASSESSMENT FOR SELECTION AND OPERATION OF THE PROPOSED FIELD RESEARCH CENTERS

March 7, 2000

12.0

Glossary

Abiotic: Not caused or produced by living beings.

Accelerated Bioremediation: Bioremediation accelerated beyond the normal actions of the naturally occurring microbial community and chemical and geological conditions, usually by the addition of nutrients or specialized microbes.

Aerobic: Living, active, or occurring only in the presence of oxygen.

Alluvium: Any stream-laid sediment deposit.

Anaerobic: Living, active, or occurring in the absence of free oxygen.

Anisotropy: The condition of exhibiting properties with different values when measured in different directions.

Anoxic: An environment without oxygen.

Aquifer: Stratum of permeable rock, sand, or gravel that can store and supply groundwater to wells and springs.

Archaea: A group of prokaryotic single-celled microorganisms that constitute the recently recognized Archaea phylogenetic domain. Archaea can be distinguished from bacteria in that their cell walls do not have murein, a peptidoglycan-containing muramic acid. Another unique feature of archaea is the presence of isopranyl ether lipids in their cell membranes. The Archaea domain includes the methanogens, most extreme halophiles (needing salt for growth), certain sulfate reducers, hyperthermophiles (optimum growth temperature of 80C or higher), and the genus *Thermoplasma*.

Area: The measure of a planar region or the surface of a solid.

Bacteria: A group of prokaryotic single-celled microorganisms that constitute the Bacteria phylogenetic domain. Unlike archaea, their cell walls have murein, a peptidoglycan-containing muramic acid. Bacteria may have spherical (coccus), rod-like (bacillus), or curved (vibrio, spirillum, or spirochete) bodies. They inhabit virtually all environments, including soil, water, organic matter, and the bodies of eukaryotes.

Bacteriophage: A virus that attacks bacteria.

Basalt: A fine-grained igneous rock dominated by dark-colored minerals.

Bioaccumulation: Intracellular accumulation of environmental pollutants, such as heavy metals, by living organisms.

Bioaugmentation: The addition of microorganisms to the environment.

Biodegradation: The breakdown of organic materials into simpler components by microorganisms.

Bioremediation: The use of living organisms to reduce or eliminate environmental hazards resulting from accumulations of toxic chemicals and other hazardous wastes.

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Biosequestration: The conversion of a compound through biological processes to a form that is chemically or physically isolated or inert.

Biostimulation: Addition of nutrients, oxygen, or other electron donors and acceptors to increase microbial activity and biodegradation.

Biotic: Caused or produced by living beings.

Biotransformation: Alteration of the structure of a compound by a living organism or enzyme.

Catalyst: A substance that activates a chemical reaction and is not itself changed in the process.

Chelator: Any of a class of relatively stable coordination compounds consisting of a central metal atom attached to a large molecule, called a ligand, in a cyclic or ring structure.

Clastic: A texture shown by sedimentary rocks from deposits of mineral and rock fragments.

Complexing Agent: A dissolved ligand that binds with a simple charged or uncharged molecular species in a liquid solution to form a complex, or coordination compound.

Contaminant: Harmful or hazardous matter introduced into the environment.

Denitrification: The formation of gaseous nitrogen (N_2) or nitrogen oxide (NO) from nitrate (NO_3^-) or nitrite (NO_2^-) by microorganisms.

Diagenesis: All of the changes that occur to a fossil (or more generally any sediment) after initial burial; includes changes that result from chemical, physical as well as biological processes.

Electromagnetics : Electromagnetic instruments work by emitting a current into the ground from a transmitting coil at one end of the instrument. A secondary magnetic field, which is proportional to the subsurface conductivity is received at the other end of the instrument and recorded. Later the operator, using a graphical computer program converts the readings (expressed in millmho per meter) into a two dimensional map.

Electron: A stable atomic particle that has a negative charge.

Electron Acceptor: Small inorganic or organic compound that is reduced in a metabolic redox reaction.

Electron Donor: Small inorganic or organic compound that is oxidized in a metabolic redox reaction.

Enzyme: A complex protein that acts as a catalyst in living organisms, regulating the rate at which chemical reactions proceed without itself being altered in the process.

Eukarya: The phylogenetic domain consisting of one-celled and multicelled organisms called eukaryotes that maintain their genome within a defined nucleus.

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Evapotranspiration: The loss of water from the soil, both by evaporation and by transpiration from the plants growing there.

Flow Cells: Containers that are a few meters in size and serve as tools for examining blocks of soils and subsurface cores that are larger than the laboratory-scale core samples. They provide "controlled environments" that simulate the natural subsurface environment in a laboratory setting without field releases.

Fungi: Spore-producing eukaryotic organisms that lack chlorophyll; examples of fungi include molds, rusts, mildews, smuts, mushrooms, and yeasts.

Ground Penetrating Radar (GPR): Emit short pulses of radio-frequency electromagnetic energy into the subsurface from a transmitting antenna. The energy passes through the ground and some is reflected back to the receiving antenna. A computer processes the reflected signal, measures the strength and time between emission and reception and produces a visual representation of the subsurface.

Groundwater: Water found beneath the earth's surface that fills pores between materials, such as sand, soil, or gravel; supplies wells and springs.

Heavy Metals: Metallic elements with high molecular weights. Such metals are often residual in the environment, exhibit biological accumulation, and are generally toxic in low concentrations. Examples include chromium, mercury, and lead.

Heterogeneity: Consisting of dissimilar constituents.

Hydraulic Conductivity: The rate at which water will move through soil in response to a given potential gradient.

Hydrology: The study of the occurrence, distribution, and circulation of natural waters of the earth.

Infrastructure: Utilities and other physical support systems needed to operate a laboratory or test facility. Included are electric distribution systems, water supply systems, sewage disposal systems, and roads.

Inorganic Compounds: Chemicals that do not contain carbon, which is usually associated with life processes; for example, metals are inorganic.

In situ: In the original position or place.

Intrinsic Bioremediation: Bioremediation at a given site as a function of the naturally occurring microbial population and naturally occurring chemical, biological, and geological

conditions. Also known as natural attenuation when dominated by biological processes, or natural bioremediation.

Isotope: Any of two or more species of atoms of a chemical element with the same atomic number (number of protons) and nearly identical chemical behavior but with a different number of neutrons, hence a different atomic weight.

Karst: A barren limestone region characterized by fissures, caves, and underground channels.

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Lysimeters/Caissons: Large (holding tons of soil) open-ended canisters that can be closed with a lid, creating a closed system. Soil and sediment can be placed in the lysimeter to simulate the natural environment.

Magnetometer: Uses a sealed vessel containing a coiled copper wire surrounded by oil. The instrument generates a small current that causes the protons within the oil to spin in the direction of magnetic north. The protons then generate a small signal, which is sent to the collection part of the device via the coiled wire. By measuring the signal intensity and comparing it to a known atomic constant—the gyromagnetic ratio of the proton—the magnetic field intensity at a discrete location can be obtained.

Methanogen: Microorganism that produces methane.

Microbe (microorganism): any living organism invisible or barely visible to the naked eye and generally observable only through a microscope.

Multi-level Well Sampler: A device, up to six feet long with separators every five centimeters, that can be lowered into a well. The separators form vertical barriers to prevent water from flowing between sampling intervals. Researchers can collect samples from any depth within the well to study the water constituents, homogeneity or heterogeneity. The sampler can be left in the well for an extended period or removed after samples are collected daily.

Natural Attenuation: Degradation or transformation of contaminants in an environment via naturally occurring physical, chemical, and biological processes. May include intrinsic bioremediation.

Non-reactive Tracer: An inert substance, such as helium gas, perfluorocarbons, or bromide, that can be used to obtain a greater understanding of groundwater flow paths

and movement. When extracted from a downgradient well, an inert tracer is the same chemical or compound as that injected. See "Reactive Tracer."

Operable Unit: A regulatory term meaning the division of cleanup of a release site into discrete action units that eliminate or mitigate a release, a threat of a release, or an exposure pathway.

Organic Compounds: Chemical compounds that contain carbon and hydrogen, elements usually associated with life processes.

Oxidation-Reduction Reaction: Coupled reactions in which one compound becomes oxidized, releasing electrons, while another becomes reduced, gaining the electrons released.

Pathogen: A specific causative agent (such as a bacterium or virus) of disease.

pH: A measure of acidity and alkalinity of a solution that is a number on a scale from 0 to 14. A value of 7 represents neutrality, lower numbers indicate increasing acidity, and higher numbers increasing alkalinity. Each unit of change represents a tenfold change in acidity or alkalinity. This change in acidity or alkalinity is the negative logarithm of the effective hydrogen-ion concentration or hydrogen-ion activity in gram equivalents per liter of the solution.

Phytoremediation: Remediation using plants to remove contaminants from soils.

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Piezometers: Used to measure fluctuating groundwater levels. Piezometers are installed in monitoring wells and operate by converting pressure exerted on a submersed diaphragm into a frequency signal that is transmitted up the well to a data recorded via a wire. For each pressure, there is a corresponding frequency signal. The signal generated by each piezometer is collected in a central data recorder. The depth of groundwater is calculated factoring varying weather conditions, such as temperature and barometric pressure. Measurements of the water table can be collected at any specified time interval, depending on the researchers' needs.

Plume: An elongated body of fluid, usually mobile and varying in shape. Used to define the contaminated areas of an environment.

Precipitate: The process whereby a solid settles out of a solution.

Prokaryote: One-celled microorganism whose genome is not contained within a nucleus. Comprising the two domains Bacteria and Archaea.

Protozoan: Any of a phylum or subkingdom (Protozoa) of chiefly motile and heterotrophic unicellular protists (as amoebas, trypanosomes, sporozoans, and paramecia) that are represented in almost every kind of habitat.

Radioactivity: Spontaneous emission by radionuclides of energetic particles through the disintegration of their atomic nuclei; the rays emitted.

Radionuclide: A radioactive species of an atom. Tritium, strontium-90, and uranium —235 are radionuclides.

Reactive Tracer: A substance, such as sulfate or ammonium that may interact with groundwater, minerals in sediments, or microorganisms. When extracted from a downgradient well, a reactive tracer is not the same chemical or compound as that injected. See "Non-reactive Tracer."

Receptors: Plants, animals, and people that may be exposed to contamination. A receptor can be exposed via the air and soil pathways (e.g., inhalation, ingestion, and contact), and the surface and groundwater pathways (e.g., contact and ingestion).

Redox Reaction: Oxidation-reduction reaction, involving transfer of electrons.

Resistivity: A technique using electrodes in contact with the ground to measure electrical resistivity. The depth of investigation is a function of the electrode spacing and geometry.

Saturated Zone: An underground geologic layer in which all pores and fractures are filled with water.

Sediment: Material in suspension in water or deposited from suspension or precipitation.

Seismic Refraction: Works by inducing a sound wave into the ground by means of a percussive device and measuring the return signal at predetermined distances from the source. By measuring the time it takes for the sound wave to arrive at the receivers, the researcher is able to infer the nature of the subsurface material.

Siliceous: Of, relating to, or containing silica or a silicate.

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Stratified Sedimentary Rock: Formed, deposited, or arranged sedimentary rock in a sheetlike mass of one kind lying between beds of other kinds.

Stratigraphy: A branch of geology that deals with the origin, composition, distribution, and succession of strata.

Substrate: The substance acted upon by an enzyme.

Subsurface: The geologic zone below the surface of the earth; includes rock and sediment materials lying near but not exposed to the earth's surface.

Subsurface Geophysical Tomography: Subsurface geophysical (cross hole) tomography allows the researcher to create a horizontal profile of the subsurface using a method similar to that used from the surface to generate a vertical profile. This method first requires that bore holes be installed. The depth and diameter of the bore holes used are limited only by the size of the instruments to be lowered into them and the depth to which researchers are concerned. Instruments are lowered into at least two bore holes and a current is induced on one end. On the other end, a receiver measures the current. That reading is sent to a computer where the researchers can map the subsurface profile in the horizontal plane. By repeating this process at varying depths throughout the bore holes, they are able to generate a three dimensional profile of the subsurface. The bore holes can be backfilled when researchers have collected the data desired.

Surfactant: A natural or synthetic chemical that promotes the wetting, solubilization, and emulsification of various types of organic chemicals.

Tracer Elements: See reactive and nonreactive tracers.

Transmissivity: The rate at which water is passed through a unit width of rock under a unit hydraulic gradient.

Unsaturated Zone: An underground geologic layer in which pores and fractures are filled with a combination of air and water.

Vadose Zone: The unsaturated zone above the water table. Also known as the zone of aeration.

Volatile Organic Compounds (VOCs): Organic

compounds that evaporate at room temperature.

Water Table: The upper limit of a geologic layer wholly saturated with water.

Zone of Root Influence: Soils or sediments in which roots from surface plants may be found or that may have an altered geochemistry due to nearby root/fungal associations.

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OC00000005199579

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APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
09/549,981	04/14/2000	1723	768	TH1006 (US)	9	20	4

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c/o Shell Oil Company Intellectual Property
P O Box 2463
Houston, TX 77252-2463

Date Mailed: 06/26/2000

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THIS APPLN CLAIMS BENEFIT OF 60/129,328 04/14/1999

Foreign Applications

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Title

Situ method and apparatus for biodegradation of alkyl ethers and tertiary butyl alcohol

Preliminary Class

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